FOREST INSECT CONDITIONS ON THE TARGHEE NATIONAL FOREST
1966

The following is an evaluation of current Forest insect problems on the Targhee National Forest in 1966. Material for these evaluations was compiled from aerial survey data, from specific mountain pine beetle and spruce budworm evaluation surveys, and from observations resulting from less intensive examinations of other insect problems on the Forest this year.

The primary Forest insect problems this year are the mountain pine beetle, the spruce budworm and the sugar pine tortrix. Briefly, mountain pine beetle infestations remained epidemic with little change in number of trees killed from last year. Heavy tree killing will continue in most of the infested areas in 1967 but at a somewhat reduced rate. The all-out control effort combined with a series of favorable biological factors indicate that some relief from the catastrophic conditions of the last several years can be expected. Spruce budworm populations declined generally in the northern part of the Forest but increased in a small area in the southern end of the Forest. Defoliation of extensive areas of lodgepole pine by the sugar pine tortrix continues unabated. A more detailed discussion of these problems follows:

Mountain pine beetle, Dendroctonus ponderosae Hopk.

The mountain pine beetle continued its widespread destruction of lodgepole pine over most of the Forest this year. The overall distribution of the beetle remains essentially unchanged from last year. According to aerial survey data, the most serious infestations, as evidenced by the presence of "red tops" (trees attacked in 1965 and fading this year), persist on the south slope of Big Bend Ridge (Zone 2) west to Warm River Butte, south along the eastern slope of the Grand Teton Range (Zone 3 & 4), to and including practically all of the Rexburg District (Zone 5). Less serious infestations persist south of Sawtelle Peak and to the west on the south slope of the continental Divide. Some eastward movement of the beetle was recorded in Zone 3. Widely scattered groups of faded lodgepole pine were spotted in the headwaters of Boone Creek, Granite Creek and in the North Fork of Bitch Creek. More serious infestations were recorded in Zone 5 in Pine Creek and its tributaries. These and other infestation areas are shown on the copy of the aerial survey map mailed to the Forest Supervisor at an earlier date.

Because of the discontinuation of complete operational surveys and the utilization of 100 percent pre-spotting on the control project, the number of newly attacked trees is unknown at this time. Preliminary estimates however, indicate there are over one million new attacks this year. Of this estimated total, approximately 700,000 infested trees are on the Rexburg District.

A new infestation was discovered in the Bechler River-Cave Falls area in the extreme southwest corner of Yellowstone National Park. A preliminary

examination showed an infestation intensity of 0.9 trees per acre. At the time of this examination, however, operational surveys were in progress so the full extent of the infestation was still undetermined. Biological data taken from infested trees indicated an epidemic situation but a static to decreasing trend.

Tree killing continued in Zone 3 where control efforts were intensified last fall and this spring. Examinations showed approximately one new attack for each tree treated. Under ordinary conditions a decrease in attack ratio would be expected but actually, the opposite occurred. The relatively high reinfestation rate was probably due to one, or a combination of one or more of the following: Attacks resulted (1) from flights within the control area, from infested trees not treated, partially treated, or treated unsuccessfully, (2) from flights originating from nearby infested untreated trees on private land and, (3) from the huge reservoir of infested, untreated trees in the Rexburg District. The first possibility, although it could have occurred, would have contributed very little to the high reinfestation rate. It is most probable that the majority of new attacks resulted from one or both of the other alternatives. We suspect that individual mountain pine beetles are capable of relatively long flights - voluntary and involuntary - but positive information is lacking on mass movements and subsequent invasion of entire populations under epidemic and/or natural conditions.

Observations were made this spring as to the extent and time of suspected early emergence from a typical overwintering brood. There were two possibilities to consider: (1) premature spring flights resulting from adult beetles that overwintered in dead trees attacked in fall of 1964; and (2) early emergence and subsequent spring attacks of other adult beetles that failed to complete egg deposition in fall of 1965. Regarding the first possibility, periodic examinations of caged trees showed that some early emergence occurred (approximately 3 weeks before the main flight) but the number of emerged beetles was too few to be of significance. As to the second contingency no early spring flight was observed nor were there any new spring attacks found. Nevertheless, it is possible that flights of a low magnitude, if they did occur, may have gone unnoticed, or the emerged beetles attacked previously infested trees. In either event, such a phenomenon would be of minor consequence and would make no appreciable impact on the infestation.

Over the season, any initial variation in brood development usually levels out by the later development stages, at which time almost simultaneous emergence occurs. This year the peak of emergence over the Forest as a whole was during the last week in July.

Although mountain pine beetle populations remained at epidemic levels, some relief from the persistent pattern of increased tree killing is in sight, for a slight but rather general decrease in infestation intensity is predicted for 1967 by interpretation of biological data and other factors. This should not be construed to indicate a lessening of control activities,

for the outbreak is still epidemic and will continue to kill hundreds of thousands of trees. The actual number of new attacks, however, should be somewhat less than this year. The only area that shows definite signs of increased activity is the Pine Creek area on the southeast side of the Rexburg District. Populations there were classed as epidemic with an increasing trend. In practically all other infestation areas, a static to decreasing trend is indicated by one or all of the following conditions:

1. Brood counts were considerably lower this year than last. Brood counts made in the fall of 1965 averaged well over 320 per square foot. This was a conservative estimate, however, because egg deposition was not complete and many of the beetles overwintered and continued egg laying this spring, resulting in much heavier broods than those measured the previous fall.

   Brood counts made this fall avereged 192 per square foot, well under the 1965 average count. (The breaking point between epidemic and endemic broods is 180). It is doubtful whether additional broods will be produced next spring, as happened this year. Examinations show that brood development is far in advance of that observed at this time last fall. In fact, rapid maturation was much above normal this year. The majority of broods were well advanced larvae; pupae were found frequently; and in some instances young (tenerals) adults were present. Considering this development state, the probability of additional brood production next spring is remote.

   The advanced broods will be highly susceptible to overwintering predation by woodpeckers, but this factor in itself has had little controlling influence on past outbreaks. Woodpeckers will occasionally completely destroy broods in individual trees, but in an infestation of this magnitude, they will be too few in number to be an effective or reliable control agent.

2. Brood mortality by natural factors was high but the effect is difficult to assess because of the advanced conditions. The development of both parasites and predators is closely syncronized with that of the host, consequently, they too were in advanced steges. During normal years, we would not expect to find this degree of development until late spring or early summer. In addition to parasites and predators, dessication, intergallery competition, disease, and competition from Ips beetles, all contribute greatly to brood reduction. Mature larvae and pupae are less able to withstand extreme winter temperatures than immature brood steges or adults. Thus, additional mortality will likely occur this winter and next spring but the full effect will not be known until next spring.

3. Ips beetles were found in practically all of the trees sampled this year. They are intense competitors and have to be considered as a major factor in regulating mountain pine beetle broods. In past years,

mountain pine beetle populations were so aggressive and their attacks so massive that competitive species were, in effect, prevented from making attacks. This year Ips beetles were able to follow the mountain pine beetle and successfully establish broods because of the lower incidence of mountain pine beetle attacks.

After successfully attacking, aided by warm, dry weather, Ips broods developed rapidly, to become strong competitions for the mountain pine beetle food supply. The Ips encroachment will cause the trees to dry out more rapidly than normal - some were already fading in the fall, while others will discolor earlier than usual next spring.

Since the first mountain pine beetle outbreak on the Targhee National Forest, there has been a slow but steady buildup of Ips beetles. In normal years Ips beetles are found almost anywhere in a coniferous forest - in windthrow, in logging and thinning slash, and occasionally in the tops of standing trees. After conditions become favorable, by sheer numbers alone, they are able to overcome apparently healthy trees. They become established by filling in the tops of both treated and untreated mountain pine beetle killed trees and have continued to sustain themselves in tree tops and other noncompetitive locations until now.

The status of Ips beetles is unknown at this time. There is a possibility the Ips broods will precede mountain pine beetle emergence next year and attack standing green trees but it is more or less remote. Most likely Ips beetles will continue to fill in behind normal mountain pine beetle attacks.

4. Two important extrinsic factors regulating mountain pine beetle populations are control and host depletion. Both are difficult to assess, however. There is little doubt that, in the absence of control work, mountain pine beetle populations and subsequent tree loss would have been much greater than they have been; also, lack of nearby host material increases the search radius, thereby increasing adult mortality and diluting the population by spreading it over a larger area. This, of course, extends the infestation boundaries and might even increase tree killing in contiguous areas having suitable host material. In other areas with less favorable conditions, the mountain pine beetle population will deplete itself from within.

5. The ratio of "pitchouts" to newly attacked trees was considerably higher this year than last. This may indicate increased tree vigor or low insect vigor or both. Strip attacks were common in some areas but it is unlikely that they will produce broods, because of sour sap conditions.

In summary, the mountain pine beetle continues to be epidemic and tree killing will continue in 1967 but at a somewhat reduced rate. The only notable exception will be in Zone 5 in Pine Creek and its tributaries where

tree mortality will increase. Zones 1, 2 and 3 will show a slight decrease; Zone 5, with the exception of Pine Creek, will be static to decreasing.

Spruce budworm, Choristoneura fumiferana (Clem.)

Spruce budworm populations and subsequent defoliation decreased in some areas and increased in others this year. Predictions made in 1965 forecast a receding population trend in all of the infestation areas this year. This population decline occurred throughout all of the previously infested areas, but the extent of the decline exceeded initial predictions. From the air no defoliation was visible in the 97,000 acres defoliated in 1965. This includes over 9,000 acres of heavy 1965 defoliation in the area east of Humphrey.

The reasons for this unexpected decline in budworm numbers is two-fold: First, 1965 egg mass counts were generally low and indicated light populations, hence light defoliation, in the infestation areas; secondly, unseasonable frosts during September of last year and June of this year further limited the already decreasing budworm population. The June frosts took a heavy toll for they followed an unusually warm May which hastened both tree and budworm development, making them less able to withstand subfreezing conditions.

The frosts were not nearly as severe on the Targhee as they were elsewhere in the Region, however. The same series of early and late frosts dealt the spruce budworm a major setback on the Salmon, Payette and Challis National Forests in Idaho and the Fishlake National Forest in Utah.

One area where these frosts failed to affect the budworm adversely is in the Pine Creek drainage in the southern end of the Forest. Defoliation confined to only a small area last year, increased to over 14,000 acres this year. Major areas of defoliation were Pole Canyon, Mike Spencer Canyon and along the south slope of Ramsey Creek. All feeding activity was classed as light with Douglas-fir, subalpine fir and Engelmann spruce the prime hosts. Interestingly, feeding damage on Douglas-fir was considerably lighter than that on true fir and spruce, which is usually not the case. For comparative purposes, a breakdown of infected acreage by damage classes for this year and last as determined by aerial surveys follows:

Year	Defoliation Intensity			
	Light	Medium	Heavy	Total
1965	46,100	42,600	9,200	97,900
1966	14,600	-	-	14,600

Of considerable importance is the fact that no areas underwent heavy or even moderate defoliation this year. Many trees that have undergone repeated defoliation for several successive years will have an opportunity

to recover.

Egg mass collections taken from Douglas-fir foliage provide an estimate of population trend and expected damage. Collections were made in previously defoliated areas and in new areas. The results of the egg mass survey and predictions as to the degree of damage that can be expected in 1967 follows:

Area	Egg masses/1000 sq. in. 1965 (No.)	1966 (No.)	Expected Defoliation 1967 (Percent)	Trend
Targhee Creek	0.0	0.0	< 15	Static
Howard Springs	0.0	0.0	< 15	Static
Twin Creek	0.0	0.1	< 15	Static
Gillen Creek	0.7	0.1	< 15	Static
Pole Creek	-	2.2	< 15	Unknown
Mike Spencer Creek	-	.5	<15	Unknown

Heaviest defoliation will occur in and near the Pine Creek drainage but this will still remain in the light category. All other areas will receive light to negligible defoliation. In some areas the sugar pine tortrix, Choristoneura lambertiana, may confound the situation somewhat for when it is epidemic in lodgepole pine, it will feed on Douglas-fir, true fir, and Engelmann spruce, when those species are components of a lodgepole stand. This defoliator complex will be investigated at greater length next summer.

Spider mite populations in the 1963 DDT spray area and elsewhere on the Forest are at a low level and should remain in that status through 1967.

Sugar pine tortrix, Choristoneura lambertiana

Past defoliation of lodgepole pine was caused by a complex of lepidopterous defoliators, namely the sugar pine tortrix, Choristoneura lambertiana, the jack pine budworm, Choristoneura pinus, and the pine needle sheath miner, Zellería haimbachi. This year, because of interspecies competition and a host of unknown biological factors the sugar pine tortrix became the principal defoliator while its two competitors diminished to insignificant levels.

Aerial surveys show that the extent of area defoliated by the sugar pine tortrix has changed very little from that recorded last year. Heavy to severe feeding still persists in the extensive lodgepole pine stands west of Bishop Mountain. Noticeable defoliation occurred along the top of

Big Bend Ridge, in Robinson Creek, and throughout the contiguous lodgepole stands along the lower west slope of the Grand Teton Range between Squirrel Creek and Teton Creek. Spotty, light defoliation was observed by ground crews in the lower portion of Pine Creek.

The aerial survey reported more than 100,000 acres of visible defoliation this year. Certain physical characteristics of lodgepole pine, however, combined with the feeding habits of the sugar pine tortrix, make detection from the air extremely difficult. One difficulty is that most of the new lodgepole growth is vertically oriented; also, the tortrix feeds entirely on new growth and masks its activity by containing its damage (dead needles, frass, etc.) in a loosely spun web around the defoliated shoot. The upright shoots, combined with other factors such as relation to the sun, angle of sight, and time of day, make accurate observation and recording of outbreak boundaries extremely difficult. The actual extent of the infestation could be considerably larger than estimated.

As stated earlier, damage from this insect is confined to the new growth. In some areas, particularly the Bishop Mountain infestation, practically all of the new growth was consumed. Although this particular area has been under heavy attack for years, tree mortality has not yet occurred. All size and age classes are attacked but even the most heavily damaged trees apparently refoliate the following year. The impact of the damage on tree growth is unknown but undoubtedly some growth loss does occur. The impact of repeated heavy damage on the stand, however, could conceivably weaken the trees to a point where they would be highly susceptible to attack by other insects - secondary as well as primary.

Since the infestation has been in progress we have had ample opportunity to observe and record various information concerning the biology and habits of the insect, heretofore unknown. These efforts will be continued in order to secure data needed to accurately forecast anticipated damage. Egg masses were collected this year as an indicator of next year's potential population level, but valid comparative data are lacking. It was evident, however, that biological control factors such as parasites, predators, disease, and starvation were not sufficient to have much effect on this year's population level. Unless additional factors act on the population this winter and next spring, no change in either the intensity or extent of the infestation is foreseen for 1967.

William H. Klein

WILLIAM H. KLEIN, Entomologist